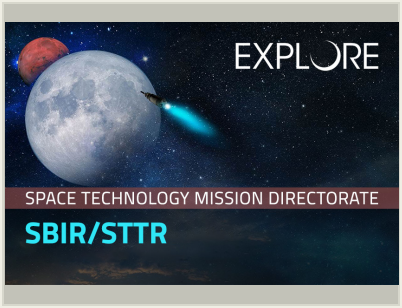
Reliable Autonomous Surface Mobility (RASM) in Support of Human Exploration, Phase I

Completed Technology Project (2010 - 2011)

Project Introduction

ProtoInnovations, LLC and Carnegie Mellon University have formed a partnership to commercially develop rover-autonomy technologies into Reliable Autonomous Surface Mobility (RASM). Our aim is to provide safe and reliable means for lunar rovers to travel at substantial speeds and operate in proximity to astronauts and other vehicles. Our unique partnership brings together state-of-art technologies for autonomous rover navigation with experience in delivering and supporting mobility systems for NASA. The RASM project will create an autonomy framework that is capable of supporting off-road vehicle speeds beyond 3 m/s with planetary-relevant constraints including a lack of infrastructure (such as GPS) and limited communication and computing resources. Our RASM framework is based on environment modeling, obstacle avoidance, path planning, and localization algorithms developed by Carnegie Mellon and proven by hundreds of kilometers of traverse in planetary analog landscapes on Earth. On the RASM project we will mature and package these algorithms in a reliable and portable software architecture that supports a variety of vehicle platforms, sensors, and middleware alternatives. Unique to RASM will be a failure-modes analysis of the autonomy system to model and mitigate hazards posed by operating alongside astronauts and lunar vehicles. Mission constraints and operating scenarios will vary broadly, so RASM will be adaptable. We will develop abstraction layers to enable portability across various vehicle chassis configurations, perception sensors, localization sensors, and communications protocols. In Phase 1 of our project, we will demonstrate the ease with which RASM can be ported by implementing it on a rover such as the Lunar All-Terrain Utility Vehicle (LATUV) developed by ProtoInnovations. Our goal is to advance autonomy-system TRL from 4 to 6 on the contract.



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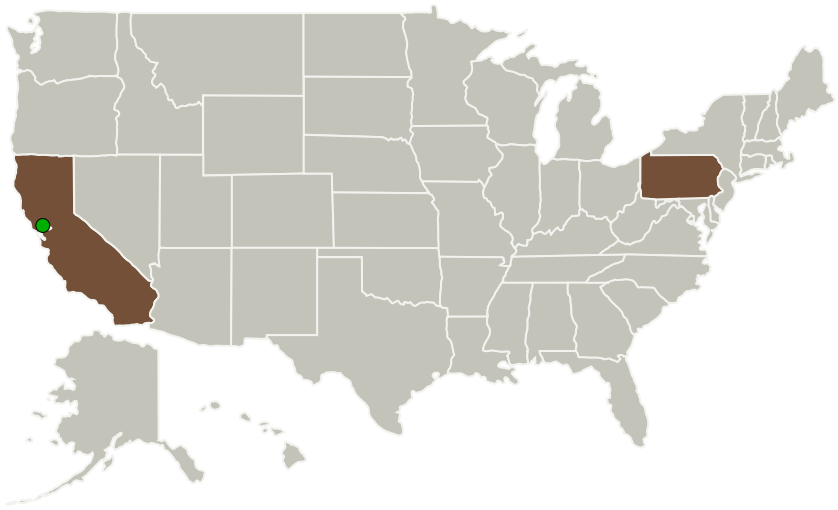
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Protoinnovations, LLC	Lead Organization	Industry	Pittsburgh, Pennsylvania
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Carnegie Mellon University	Supporting Organization	Academia	Pittsburgh, Pennsylvania

Primary U.S. Work Locations	
California	Pennsylvania

Project Transitions

January 2010: Project Start

January 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140127)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Protoinnovations, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

David Wettergreen

Co-Investigator:

David Wettergreen

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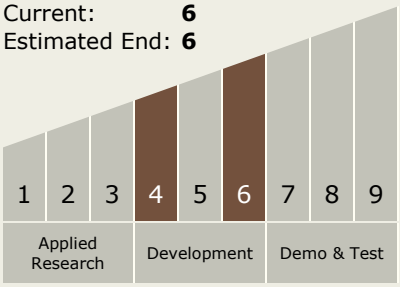
Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.5 Robot Navigation and Path Planning

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System